CITY OF NEW BEDFORD

Water/Wastewater Department

Ronald H. Labelle
Commissioner

Frederick M. Kalisz, Jr.
Mayor

cc: D. Dwight
L. Coppetelli
C. Costhebary
File # 118
Sullivan's Ledge

February 26, 2003

Mr. Stephen Wood
Environmental Science Services, Inc.
401 Wampanoag Trail, Suite 400
East Providence, Rhode Island 02915

Reference: Sullivan's Ledge Groundwater Treatment Facility

Dear Mr. Wood:

Enclosed please find copies of the monthly operating reports for the month of January 2003 and analytical reports for effluent samples collected on January 5th and 23ed.

Also enclosed is a copy of a report prepared by our contract laboratory regarding the detection of PCB's that are not the typical aroclors. These PCB homologs are often the result of weathered aroclors. I'm not sure if any additional information regarding the site conditions can be gained by conducting this procedure on future samples, however I offer it to you for review.

Should you have any questions or comments regarding the enclosed please feel free to contact me.

Sincerely,

James J. Ricci
Superintendent of Water

Cc: Mr. David Lederer, EPA
Ms. Evelina Vaughan, DEP
Mr. James R. Heckathorne, OB & G
Mr. Donald Dwight, M & E

1 Negus Way
East Freetown, MA 02717
508-763-2231
508-763-4494 (fax)
Jamesr@WWW.CI.NEW-BEDFORD.MA.US

SULLIVAN'S LEDGE SUPERFUND SITE

Ground Water Treatment Plant

Performance Data Summary

Day	Month/ 2003	Influent Total (gals)	Effluent Total (gals)	Flow Average	Effluent pH Low / High	Chemicals Used....gals Acid	Caustic	Peroxide	City Water	Notes
1	january									
2	january	34973	61494	43	6.1	20	135	16	673	Process on line
3	january	36717	67330	47	6.1	25	138	17	432	Process on line. Data reflects three day avg.
4	january	36717	67330	47	6.1	25	138	17	432	Process on line. Data reflects three day avg.
5	january	36717	67330	47	6.1	25	138	17	432	Process on line. Data reflects three day avg.
6	january	35083	67637	47	6.2	38	150	17	494	Process on line.
7	january	36400	69924	49	6.1	34	210	17	531	Process on line.
8	january	38165	69524	48	6.0	28	147	16	658	Process on line
9	january	39721	69762	48	6.1	37	188	17	389	Process on line.
10	january	42282	71487	50	6.0	28	155	18	472	Process on line. Data reflects three day avg.
11	january	42282	71487	50	6.0	28	155	18	472	Process on line. Data reflects three day avg.
12	january	42282	71487	50	6.0	28	155	18	472	Process on line. Data reflects three day avg.
13	january	40977	68809	48	6.0	29	147	17	486	Process on line.
14	january	39859	66061	46	6.0	29	158	17	681	Process on line.
15	january	42306	70199	49	6.0	29	146	16	367	Process on line.
16	january	42956	70800	49	6.0	25	151	18	189	Process on line.
17	january	40621	69452	48	6.0	26	133	14	226	Process on line. Data reflects four day avg.
18	january	40621	69452	48	6.0	26	133	14	226	Process on line. Data reflects four day avg.
19	january	40621	69452	48	6.0	26	133	14	226	Process on line. Data reflects four day avg.
20	january	40621	69452	48	6.0	26	133	14	226	Process on line. Data reflects four day avg.
21	january	37341	71090	49	6.0	30	135	15	239	Process on line.
22	january	37004	70988	49	6.0	27	130	15	165	Process on line.
23	january	36885	70060	49	6.0	32	177	15	591	Process on line.
24	january	36918	71864	50	6.2	26	204	17	182	Process on line. Data reflects 3 day avg.
25	january	36918	71864	50	6.2	26	204	17	182	Process on line. Data reflects 3 day avg.
26	january	36918	71864	50	6.2	26	204	17	182	Process on line. Data reflects 3 day avg.
27	january	32445	71602	50	6.0	28	135	18	389	Process down @ 10:25. Air comp. & uv/ox leak.
28	january	4795	6773		6.1	2	19	3		Process down. Air comp. Being repaired.
29	january	0	0	0	6.1	0	0	0	105	Process on line @ 0900.
30	january	25756	50053	35	6.1	21	117	10	322	Down @ 04:29 Air comp. Not working.
31	january	17364	34185	28	6.3	12	72	7	229	Data reflects 2 day avg. Proc. Down @ 15:49 on 2/1/03 low f

January

Ground Water Treatment Plant — Water levels

Day	Month/ 2003	BEI - 1	OBG -1	OBG - 2	BEI - 2	OBG - 3	BEI - 3	Pump Station	Interim Well 1	Interim Well 2
1	January									
2	January	76.1	79.8	77.9	79.5	82.6	79.1	10.0	22.2	23.1
3	January	69.2	68.0	56.5	59.4	78.9	64.5	9.7	21.3	22.2
4	January									
5	January									
6	January	69.2	68.1	58.5	59.2	78.8	64.7	9.2	21.5	21.8
7	January	69.2	68.2	58.5	59.1	78.8	64.7	9.2	21.2	22.0
8	January	69.2	68.1	58.7	59.0	78.9	64.7	9.2	21.8	23.0
9	January	69.3	68.0	58.3	59.1	78.9	64.7	9.0	21.4	22.9
10	January	69.3	68.0	58.2	58.9	78.9	64.6	8.8	21.3	22.6
11	January									
12	January									
13	January	69.3	67.9	58.0	58.7	78.5	64.4	8.5	21.6	22.6
14	January	69.3	68.4	57.9	58.7	78.6	64.3	8.5	21.6	22.6
15	January	69.3	68.0	57.9	58.8	78.6	64.4	8.5	21.2	22.6
16	January	69.3	68.2	57.7	58.7	78.5	64.3	8.5	21.2	22.5
17	January	69.3	69.2	57.7	58.7	78.5	64.4	8.5	21.6	22.4
18	January									
19	January									
20	January									
21	January	69.3	68.1	57.4	58.5	78.3	64.3	8.4	21.1	22.3
22	January	69.3	68.3	57.3	58.6	78.2	64.3	8.3	21.0	22.2
23	January	69.3	68.3	57.1	58.4	78.1	64.3	8.2	21.0	22.2
24	January	69.3	69.4	57.0	58.5	78.0	64.3	8.1	20.8	22.0
25	January									
26	January									
27	January	69.3	68.7	55.1	58.0	77.4	64.0	7.4	20.5	21.2
28	January	69.3	68.5	55.2	57.8	77.3	63.8	7.4	20.2	21.4
29	January	80.4	84.5	86.3	83.1	81.5	83.1	8.8	21.7	26.0
30	January	80.4	84.5	86.3	83.1	81.5	83.1	9.0	21.7	26
31	January	79.6	81.9	86.1	80.7	80.0	81.6	9	21.8	26

Volatile Organics by GC/MS

Client: **City of New Bedford**
Project: **Sullivan's Ledge**
Case: **N/A** SDG: **N/A**
Client ID: **Final Effluent**
Matrix: **Water**

Lab Code: **MA00030**
ETR: **0302025**
Lab ID: **0302025-02**
Associated Blank: **B1021201**
Concentration Units: **µg/L**

Date Collected	Date Received	Date Analyzed	Sample Amount (ml)	Final Volume (ml)	Dilution Factor	Analyst
02/06/03	02/06/03	02/12/03	5	5	1	MLR

Parameter	Result		Parameter	Result	
Chloromethane	**1.0**	J	1,2-Dichloroethane	2.0	U
Vinyl chloride	**3.5**		Trichloroethene	**94**	
Bromomethane	2.0	U	1,2-Dichloropropane	2.0	U
Chloroethane	**6.9**		Bromodichloromethane	2.0	U
Trichlorofluoromethane	2.0	U	2-Chloroethylvinyl ether	5.0	U
1,1-Dichloroethene	1.0	U	Methyl isobutyl ketone (MIBK)	**2.1**	
Acrolein	2.0	U	cis-1,3-Dichloropropene	0.50	U
Acetone	**41**		Toluene	2.0	U
Carbon disulfide	2.0	U	trans-1,3-Dichloropropene	0.50	U
Methylene chloride	5.0	U	1,1,2-Trichloroethane	2.0	U
Methyl tert-butyl ether (MTBE)	2.0	U	2-Hexanone	2.0	U
trans-1,2-Dichloroethene	**6.2**		Tetrachloroethene	**1.4**	J
1,1-Dichloroethane	2.0	U	Dibromochloromethane	2.0	U
Vinyl acetate	2.0	U	Chlorobenzene	**11**	
2-Butanone (MEK)	**4.2**		Ethylbenzene	2.0	U
cis-1,2-Dichloroethene	**310**	E	p/m-Xylene	4.0	U
Chloroform	2.0	U	o-Xylene	2.0	U
1,1,1-Trichloroethane	2.0	U	Styrene	2.0	U
Carbon tetrachloride	2.0	U	Bromoform	**1.3**	J
Benzene	**14**		1,1,2,2-Tetrachloroethane	2.0	U

cis-1.3-Dichloropropene and trans-1,3-Dichloropropene are reported to the method detection limit to meet reporting limits.

Surrogate	% Recovery		Acceptance Range (%)
Dibromofluoromethane	112		86-116
Toluene-d8	64	§	87-111
4-Bromofluorobenzene	94		79-112

§ - Surrogate value outside of acceptable range.
E - Estimated value, exceeds the upper limit of calibration.
J - Estimated value, below quantitation limit.
U - The analyte was analyzed for but not detected at the sample specific level reported.
N/A - Not Applicable

02/14/03 15:12

Volatile Organics by GC/MS

Client: **City of New Bedford**
Project: **Sullivan's Ledge**
Case: **N/A** SDG: **N/A**
Client ID: **Final Effluent**
Matrix: **Water**

Lab Code: **MA00030**
ETR: **0302025**
Lab ID: **0302025-02E**
Associated Blank: **B1021201**
Concentration Units: **µg/L**

Date Collected	Date Received	Date Analyzed	Sample Amount (ml)	Final Volume (ml)	Dilution Factor	Analyst
02/06/03	02/06/03	02/12/03	5	5	2	MLR

Parameter	Result		Parameter	Result	
Chloromethane	4.0	U	1,2-Dichloroethane	4.0	U
Vinyl chloride	**4.9**		Trichloroethene	**81**	
Bromomethane	4.0	U	1,2-Dichloropropane	4.0	U
Chloroethane	**6.3**		Bromodichloromethane	4.0	U
Trichlorofluoromethane	4.0	U	2-Chloroethylvinyl ether	10	U
1,1-Dichloroethene	2.0	U	Methyl isobutyl ketone (MIBK)	4.0	U
Acrolein	4.0	U	cis-1,3-Dichloropropene	1.0	U
Acetone	**43**		Toluene	4.0	U
Carbon disulfide	4.0	U	trans-1,3-Dichloropropene	1.0	U
Methylene chloride	10	U	1,1,2-Trichloroethane	4.0	U
Methyl tert-butyl ether (MTBE)	4.0	U	2-Hexanone	4.0	U
trans-1,2-Dichloroethene	**5.6**		Tetrachloroethene	4.0	U
1,1-Dichloroethane	4.0	U	Dibromochloromethane	4.0	U
Vinyl acetate	4.0	U	Chlorobenzene	**9.8**	
2-Butanone (MEK)	**4.7**		Ethylbenzene	4.0	U
cis-1,2-Dichloroethene	**310**		p/m-Xylene	8.0	U
Chloroform	4.0	U	o-Xylene	4.0	U
1,1,1-Trichloroethane	4.0	U	Styrene	4.0	U
Carbon tetrachloride	4.0	U	Bromoform	4.0	U
Benzene	**13**		1,1,2,2-Tetrachloroethane	4.0	U

cis-1,3-Dichloropropene and trans-1,3-Dichloropropene are reported to the method detection limit to meet reporting limits.

Surrogate	% Recovery		Acceptance Range (%)
Dibromofluoromethane	121	§	86-116
Toluene-d8	78	§	87-111
4-Bromofluorobenzene	96		79-112

§ - Surrogate value outside of acceptable range.
U - The analyte was analyzed for but not detected at the sample specific level reported.
N/A - Not Applicable

02/14/03 15:12

Polychlorinated Biphenyls by GC/ECD

Client: **City of New Bedford**
Project: **Sullivan's Ledge**
Case: **N/A** SDG: **N/A**
Client ID: **Final Effluent**
Matrix: **Water**

Lab Code: **MA00030**
ETR: **0302025**
Lab ID: **0302025-01**
Associated Blank: **PW0210B1**
Concentration Units: **µg/L**

Date Collected	Date Received	Date Extracted	Date Analyzed	Sample Amount (ml)	Final Volume (ml)	Dilution Factor	Analyst
02/06/03	02/06/03	02/10/03	02/11/03	960	10	1	NLJr

Parameter	Result
Aroclor 1016	0.52 U
Aroclor 1221	0.52 U
Aroclor 1232	0.52 U
Aroclor 1242	0.52 U
Aroclor 1248	0.52 U
Aroclor 1254	0.52 U
Aroclor 1260	0.52 U

Surrogate	% Recovery	Acceptance Range (%)
Tetrachloro-meta-xylene	71	30-150
Decachlorobiphenyl	71	30-150

U - The analyte was analyzed for but not detected at the sample specific level reported.
N/A - Not Applicable

02/11/03 16:22

Total Metals

Client: **City of New Bedford**
Project: **Sullivan's Ledge**
Case: **N/A** SDG: **N/A**
Client ID: **Final Effluent**
Matrix: **Water**

Lab Code: **MA00030**
ETR: **0302025**
Lab ID: **0302025-01**
Concentration Units: **µg/L**
Date Collected: **02/06/03**
Date Received: **02/06/03**

Parameter	Result	Qualifier	Reporting Limit	Dilution	Date Analyzed	Date Prepared	Analytical Method	Analyst
Arsenic	200	U	200	1	02/11/03	02/10/03	6010B	LMR
Cadmium	10	U	10	1	02/11/03	02/10/03	6010B	LMR
Chromium	20	U	20	1	02/11/03	02/10/03	6010B	LMR
Copper	20	U	20	1	02/11/03	02/10/03	6010B	LMR
Lead	200	U	200	1	02/11/03	02/10/03	6010B	LMR
Mercury	0.20	U	0.20	1	02/10/03	02/10/03	7470A	CLM
Molybdenum	100	U	100	1	02/11/03	02/10/03	6010B	LMR
Nickel	40	U	40	1	02/11/03	02/10/03	6010B	LMR
Silver	20	U	20	1	02/11/03	02/10/03	6010B	LMR
Zinc	37		20	1	02/11/03	02/10/03	6010B	LMR

U - The analyte was analyzed for but not detected at the sample specific level reported.
N/A - Not Applicable

375 Paramount Drive, Suite 2, Raynham, Massachusetts 02767, (508) 822-9300, Fax (508) 822-3288, whale@whgrp.com

Inorganics

Client: **City of New Bedford**
Project: **Sullivan's Ledge**
Case: **N/A** SDG: **N/A**
Client ID: **Final Effluent**
Matrix: **Water**

Lab Code: **MA00030**
ETR: **0302025**
Lab ID: **0302025-02**
Date Collected: **02/06/03**
Date Received: **02/06/03**

Parameter	Result	Qualifier	Reporting Limit	Dilution	Date Analyzed	Unit	Analytical Method	Analyst
Cyanide, Total	**0.055**		0.005	1	02/08/03	mg/L	9014	DEB

N/A - Not Applicable

375 Paramount Drive, Suite 2, Raynham, Massachusetts 02767, (508) 822-9300, Fax (508) 822-3288, whale@whgrp.com

Volatile Organics by GC/MS

Client: **City of New Bedford**
Project: **Sullivan's Ledge**
Case: N/A SDG: N/A
Client ID: **Final Eff.**
Matrix: **Water**

Lab Code: **MA00030**
ETR: **0301102**
Lab ID: **0301102-02**
Associated Blank: **B1012801**
Concentration Units: **µg/L**

Date Collected	Date Received	Date Analyzed	Sample Amount (ml)	Final Volume (ml)	Dilution Factor	Analyst
01/23/03	01/24/03	01/28/03	5	5	1	MLR

Parameter	Result		Parameter	Result	
Chloromethane	**4.2**		1,2-Dichloroethane	2.0	U
Vinyl chloride	2.0	U	Trichloroethene	**22**	
Bromomethane	2.0	U	1,2-Dichloropropane	2.0	U
Chloroethane	**6.8**		Bromodichloromethane	2.0	U
Trichlorofluoromethane	2.0	U	2-Chloroethylvinyl ether	5.0	U
1,1-Dichloroethene	1.0	U	Methyl isobutyl ketone (MIBK)	2.0	U
Acrolein	2.0	U	cis-1,3-Dichloropropene	0.50	U
Acetone	**37**		Toluene	2.0	U
Carbon disulfide	2.0	U	trans-1,3-Dichloropropene	0.50	U
Methylene chloride	5.0	U	1,1,2-Trichloroethane	2.0	U
Methyl tert-butyl ether (MTBE)	2.0	U	2-Hexanone	2.0	U
trans-1,2-Dichloroethene	**3.3**		Tetrachloroethene	2.0	U
1,1-Dichloroethane	2.0	U	Dibromochloromethane	2.0	U
Vinyl acetate	2.0	U	Chlorobenzene	**2.0**	
2-Butanone (MEK)	**3.6**		Ethylbenzene	2.0	U
cis-1,2-Dichloroethene	**55**		p/m-Xylene	4.0	U
Chloroform	2.0	U	o-Xylene	2.0	U
1,1,1-Trichloroethane	2.0	U	Styrene	2.0	U
Carbon tetrachloride	2.0	U	Bromoform	2.0	U
Benzene	**1.9**	J	1,1,2,2-Tetrachloroethane	2.0	U

cis-1,3-Dichloropropene and trans-1,3-Dichloropropene are reported to the method detection limit to meet reporting limits.

Surrogate	% Recovery		Acceptance Range (%)
Dibromofluoromethane	101		86-116
Toluene-d8	49	§	87-111
4-Bromofluorobenzene	90		79-112

§ - Surrogate value outside of acceptable range.
J - Estimated value, below quantitation limit.
U - The analyte was analyzed for but not detected at the sample specific level reported.
N/A - Not Applicable

01/29/03 14:52

Polychlorinated Biphenyls by GC/ECD

Woods Hole Group

Client: **City of New Bedford**
Project: **Sullivan's Ledge**
Case: **N/A** SDG: **N/A**
Client ID: **Final Eff.**
Matrix: **Water**

Lab Code: **MA00030**
ETR: **0301102**
Lab ID: **0301102-01**
Associated Blank: **PW0124B1**
Concentration Units: **µg/L**

Date Collected	Date Received	Date Extracted	Date Analyzed	Sample Amount (ml)	Final Volume (ml)	Dilution Factor	Analyst
01/23/03	01/24/03	01/24/03	01/29/03	980	10	1	DMD

Parameter	Result
Aroclor 1016	0.51 U
Aroclor 1221	0.51 U
Aroclor 1232	0.51 U
Aroclor 1242	0.51 U
Aroclor 1248	0.51 U
Aroclor 1254	0.51 U
Aroclor 1260	0.51 U

Surrogate	% Recovery	Acceptance Range (%)
Tetrachloro-meta-xylene	104	30-150
Decachlorobiphenyl	49	30-150

U - The analyte was analyzed for but not detected at the sample specific level reported.
N/A - Not Applicable

01/30/03 19:06

Woods Hole Group
Environmental Laboratories

375 Paramount Drive • Suite 2
Raynham, MA 02767-5154 • USA
Phone: 508-822-9300
Fax: 508-822-3288

February 11, 2003

Mr. James Ricci
City of New Bedford
1105 Shawmut Avenue
New Bedford, MA 02746

Dear Jim:

Per our discussion, please find enclosed copies of chromatograms for two sampling locations at Sullivan's Ledge. Samples Final Effluent and Collection Trench (0301102-01 and 0301103-01), both collected on January 23, 2003 requested Polychlorinated Biphenyl (PCB) Aroclor analysis. Upon data review, both samples exhibited concentrations for PCB's, but not aroclors. As a result, data reported for both of these samples was "non detect". "PCB's may be identified and quantified as the PCB aroclor, as an individual isomer or congener, or according to their degree of chlorination or homolog grouping".

Concentrations for PCB's are identified by pattern recognition. To date, we have not seen this pattern in any of the samples previously received for Sullivan's Ledge. PCB's have the potential to weather over time, causing them to change their molecular structures - and subsequently, their patterns. Although their structures change, their toxicity does not. To identify weathered PCB's, either congener or homolog analysis must be performed.

We believe to properly identify the PCB's in your samples, PCB homolog (method 680) analysis should be performed. I have included a copy of our technical bulletin, *"Method 680 – PCB Homologs and Congeners. An Alternate Method (Part 1)"* for your review. I believe this explains the different PCB identifications as thoroughly, yet simply as possible.

I hope this information helps you in your decision. Please call me with any questions you may have. Should you decide to go forward with the PCB homolog analysis, let me know.

Sincerely,

Robin Breneiser

Robin Breneiser
Project Manager

enclosures

Quantitation Report (QT Reviewed)

Signal #1 : C:\HPCHEM\1\DATA\JAN28\01102-01.D\ECD1A.CH Vial: 25
Signal #2 : C:\HPCHEM\1\DATA\JAN28\01102-01.D\ECD2B.CH
Acq On : 1-29-03 3:34:00 AM Operator: DMD
Sample : 0301102-01 Inst : GC 6890
Misc : 1X Multiplr: 1.00
IntFile Signal #1: autoint1.e IntFile Signal #2: autoint2.e
Quant Time: Jan 30 14:03 2003 Quant Results File: A128481P.RES

Quant Method : C:\HPCHEM\1\METHODS\A128481P.M (Chemstation Integrator)
Title :
Last Update : Wed Jan 29 17:30:23 2003
Response via : Initial Calibration
DataAcq Meth : A3012860.M

Volume Inj. : 1
Signal #1 Phase : RTX 5 Signal #2 Phase: RTX CLP II
Signal #1 Info : .25 Signal #2 Info : .25

Compound	RT#1	RT#2	Resp#1	Resp#2	ug/L	ug/L
Target Compounds						
) L7 A1248 1	10.73	10.89	282.8E6	185.9E6	1708.234	355.278m#
) L7 A1248 2	11.37	11.65	264.9E6	74862540	364.164	221.273m#
) L7 A1248 3	12.17	11.74	114.4E6	137.9E6	244.068	389.925m#
) L7 A1248 4	12.66	12.24	36656601	23905460	61.247	52.569m
) L7 A1248 5	12.92	12.50	77153578	47826644	104.106	82.217
Sum A1248 1			775.9E6	470.4E6	2481.819	1101.262
erage A1248 1					496.364	220.252

Jim Ricci
PCB Congeners
PCB Homologs ←
608-979-1603

1/23

980mLs
10mL f.v.

2.24ug/L

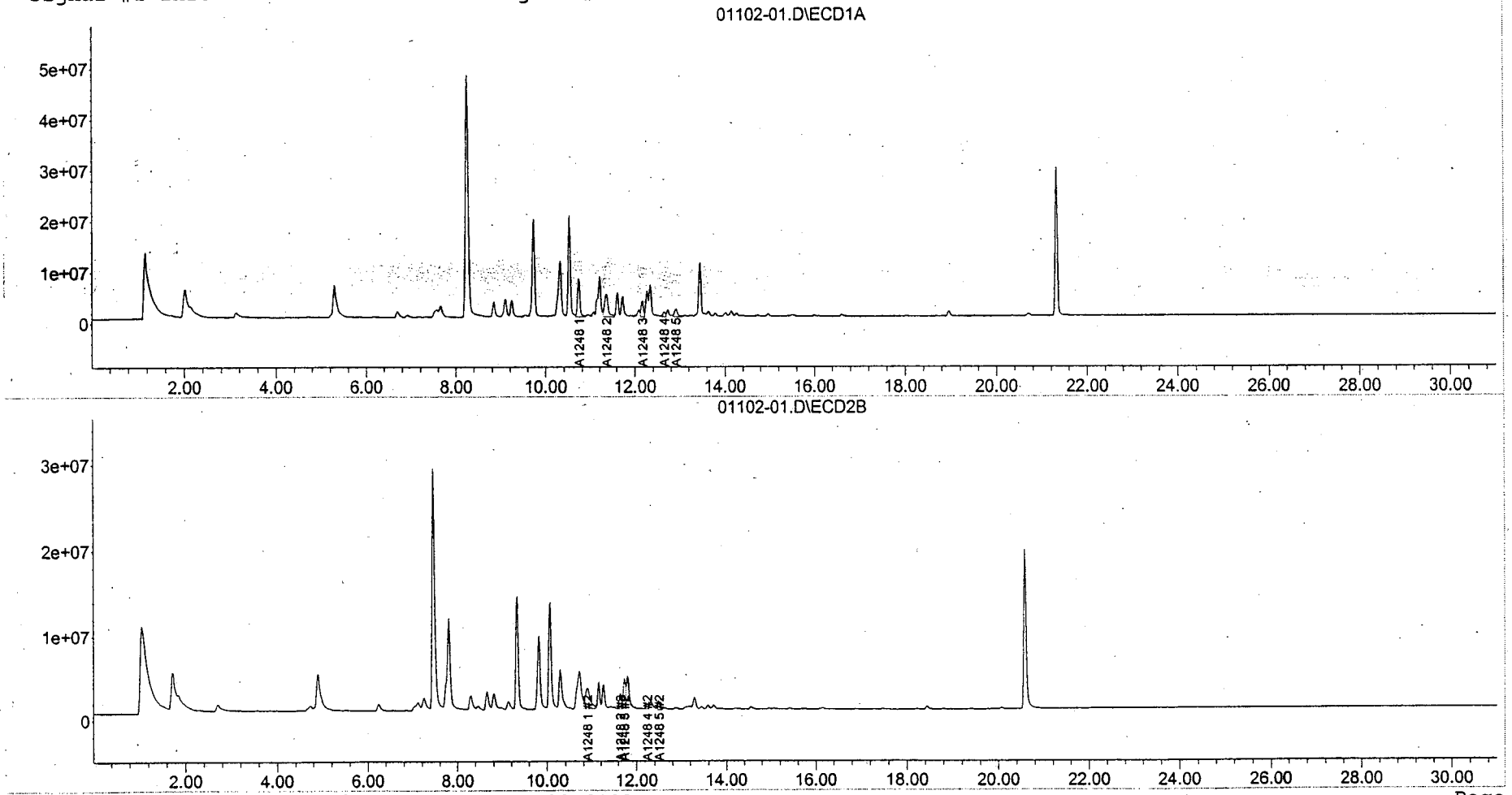
Final Effluent

(f)=RT Delta > 1/2 Window (#)=Amounts differ by > 25% (m)=manual int.

Signal #1 : C:\HPCHEM\1\DATA\JAN28\01102-01.D\ECD1A.CH Vial: 25
Signal #2 : C:\HPCHEM\1\DATA\JAN28\01102-01.D\ECD2B.CH
Acq On : 1-29-03 3:34:00 AM Operator: DMD
Sample : 0301102-01 Inst : GC 6890
Misc : 1X Multiplr: 1.00
IntFile Signal #1: autoint1.e IntFile Signal #2: autoint2.e
Quant Time: Jan 30 14:03 2003 Quant Results File: A128481P.RES

Quant Method : C:\HPCHEM\1\METHODS\A128481P.M (Chemstation Integrator)
Title :
Last Update : Wed Jan 29 17:30:23 2003
Response via : Single Level Calibration
DataAcq Meth : A3012860.M

Volume Inj. : 1
Signal #1 Phase : RTX 5 Signal #2 Phase: RTX CLP II
Signal #1 Info : .25 Signal #2 Info : .25

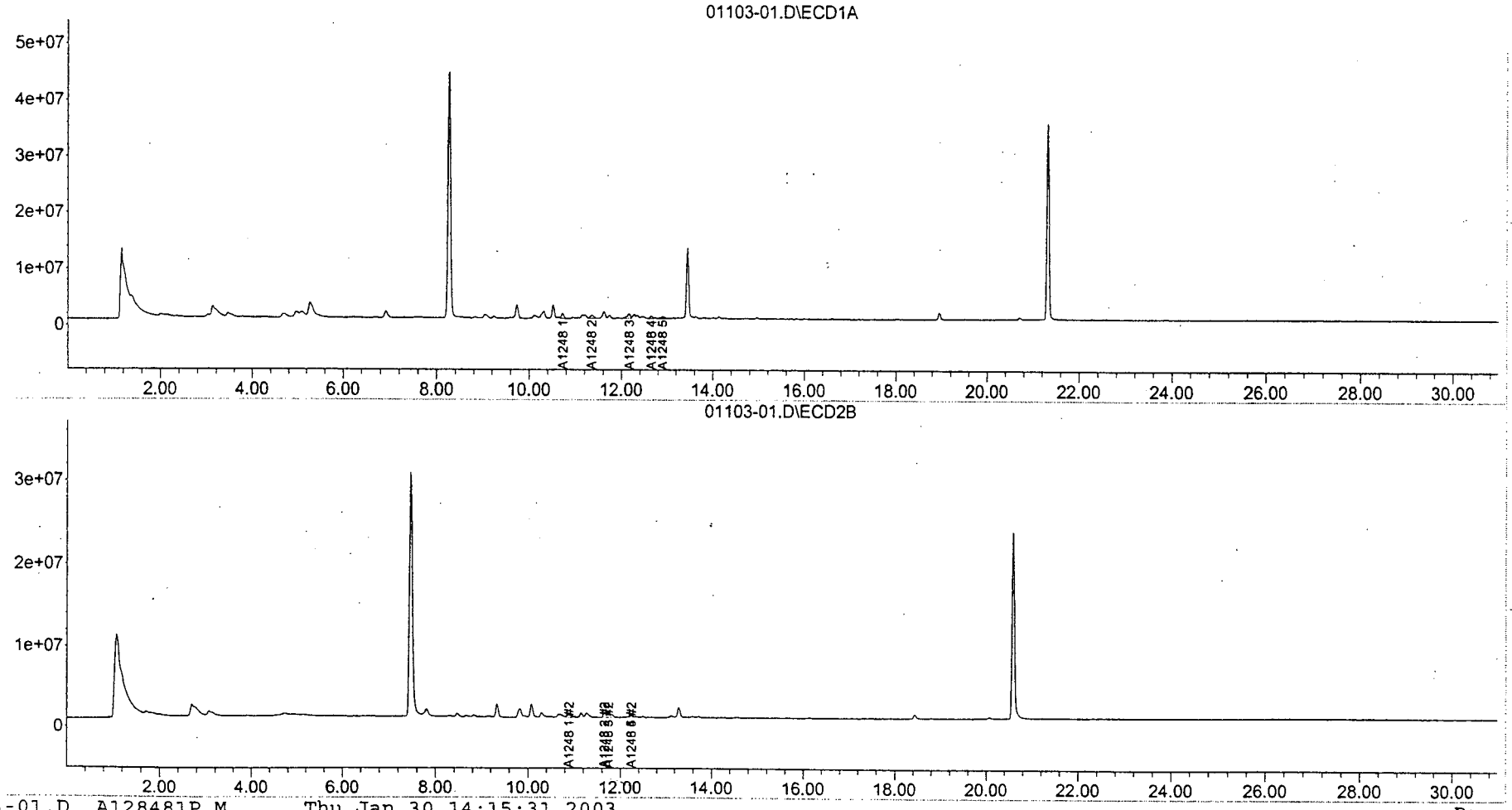


Quantitation Report

Signal #1 : C:\HPCHEM\1\DATA\JAN28\01103-01.D\ECD1A.CH Vial: 26
Signal #2 : C:\HPCHEM\1\DATA\JAN28\01103-01.D\ECD2B.CH
Acq On : 1-29-03 4:07:53 AM Operator: DMD
Sample : 0301103-01 Inst : GC 6890
Misc : 1X Multiplr: 1.00
IntFile Signal #1: autoint1.e IntFile Signal #2: autoint2.e
Quant Time: Jan 30 14:15 2003 Quant Results File: A128481P.RES

Quant Method : C:\HPCHEM\1\METHODS\A128481P.M (Chemstation Integrator)
Title :
Last Update : Wed Jan 29 17:30:23 2003
Response via : Single Level Calibration
DataAcq Meth : A3012860.M

Volume Inj. : 1
Signal #1 Phase : RTX 5 Signal #2 Phase: RTX CLP II
Signal #1 Info : .25 Signal #2 Info : .25



Quantitation Report (Not Reviewed)

Signal #1 : C:\HPCHEM\1\DATA\JAN28\01103-01.D\ECD1A.CH Vial: 26
Signal #2 : C:\HPCHEM\1\DATA\JAN28\01103-01.D\ECD2B.CH
Acq On : 1-29-03 4:07:53 AM Operator: DMD
Sample : 0301103-01 Inst : GC 6890
Misc : 1X Multiplr: 1.00
IntFile Signal #1: autoint1.e IntFile Signal #2: autoint2.e
Quant Time: Jan 30 14:15 2003 Quant Results File: A128481P.RES

Quant Method : C:\HPCHEM\1\METHODS\A128481P.M (Chemstation Integrator)
Title :
Last Update : Wed Jan 29 17:30:23 2003
Response via : Initial Calibration
DataAcq Meth : A3012860.M

Volume Inj. : 1
Signal #1 Phase : RTX 5 Signal #2 Phase: RTX CLP II
Signal #1 Info : .25 Signal #2 Info : .25

Compound	RT#1	RT#2	Resp#1	Resp#2	ug/L	ug/L
Target Compounds						
1) L7 A1248 1	10.73	10.89	32490823	23931018	196.269	45.723 #
2) L7 A1248 2	11.36	11.66	31516651	19292703	43.325	57.024 #
3) L7 A1248 3	12.17	11.75	41568318	28051380	88.660	79.331
4) L7 A1248 4	12.66	12.24	17510131	12326177	29.257	27.106
5) L7 A1248 5	12.91	12.24f	20526311	12326177	27.697	21.189
Sum A1248 1			143.6E6	95927456	385.208	230.373
Average A1248 1					77.042	46.075

990mLs
10~L F.V.

.460g/L

collection trench

(f)=RT Delta > 1/2 Window (#)=Amounts differ by > 25% (m)=manual int.
01103-01.D A128481P.M Thu Jan 30 14:15:29 2003 Page 1

TECHNICAL BULLETIN *01-001*

METHOD 680 - PCB HOMOLOGS AND CONGENERS AN ALTERNATIVE METHOD (PART 1)

Polychlorinated biphenyls (PCBs) were commercially produced for a variety of industrial applications. Their primary use was in transformer oils and hydraulic fluids. The potential for threats to the environment and human health banned the use of this persistent, bioaccumulative and toxic class of compounds. The occurrence of PCBs in the environment has not stopped even though production has. Detection, measurement and monitoring of PCBs are necessary to protect human and ecological health.

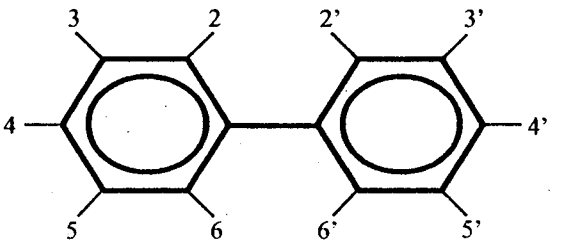
PCBs may be identified and quantified as the PCB aroclor, as an individual PCB isomer or congener, or according to their degree of chlorination or homolog grouping.

A PCB aroclor is a mixture of biphenyl molecules with one (monochlorobiphenyl) to ten (decachlorobiphenyl) chlorine atoms attached in a variety of positions (see figure 1). There is a potential of 209 substitutions or unique isomers. However all potential individual congeners are not produced in the manufacturing process. Aroclor nomenclature is associated with the degree of chlorination of a commercial PCB. The aroclor 1260 would contain 60 percent by weight of chlorine for that product. The degree of chlorination influenced the application in which the aroclor was used.

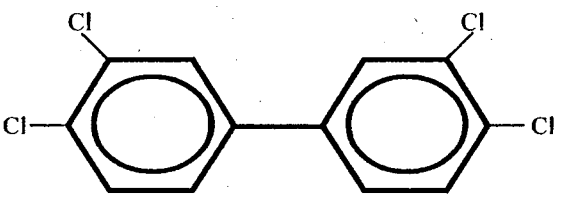
Each individual isomer is referred to as a congener with a specific International Union of Pure and Applied Chemistry (IUPAC) or Ballschmiter & Zell (BZ) number for identification. The individual congeners may be of interest because the positioning of the chlorine substitution can influence the potential toxicity of the PCB molecule. The toxicity associated with individual isomers has resulted in the World Health Organization (WHO) developing a list of congeners (Table 2) that are potentially dioxin-like in chemical activity in biological systems. These congeners are commonly referred to as "co-planar".

Figure 1. Polychlorinated Biphenyls

Positional Isomer Structure (Biphenyl)

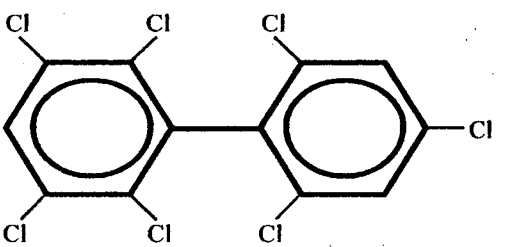


Co-Planar (Non-ortho Substitutional)



BZ 77
3,3',4,4'-Tetrachlorobiphenyl

Ortho Substitutional



BZ 188
2,2',3,4',5,6,6'-Heptachlorobiphenyl

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Figure 2. PCB Homolog Classification

Chlorination Distribution of Homologs into Aroclors

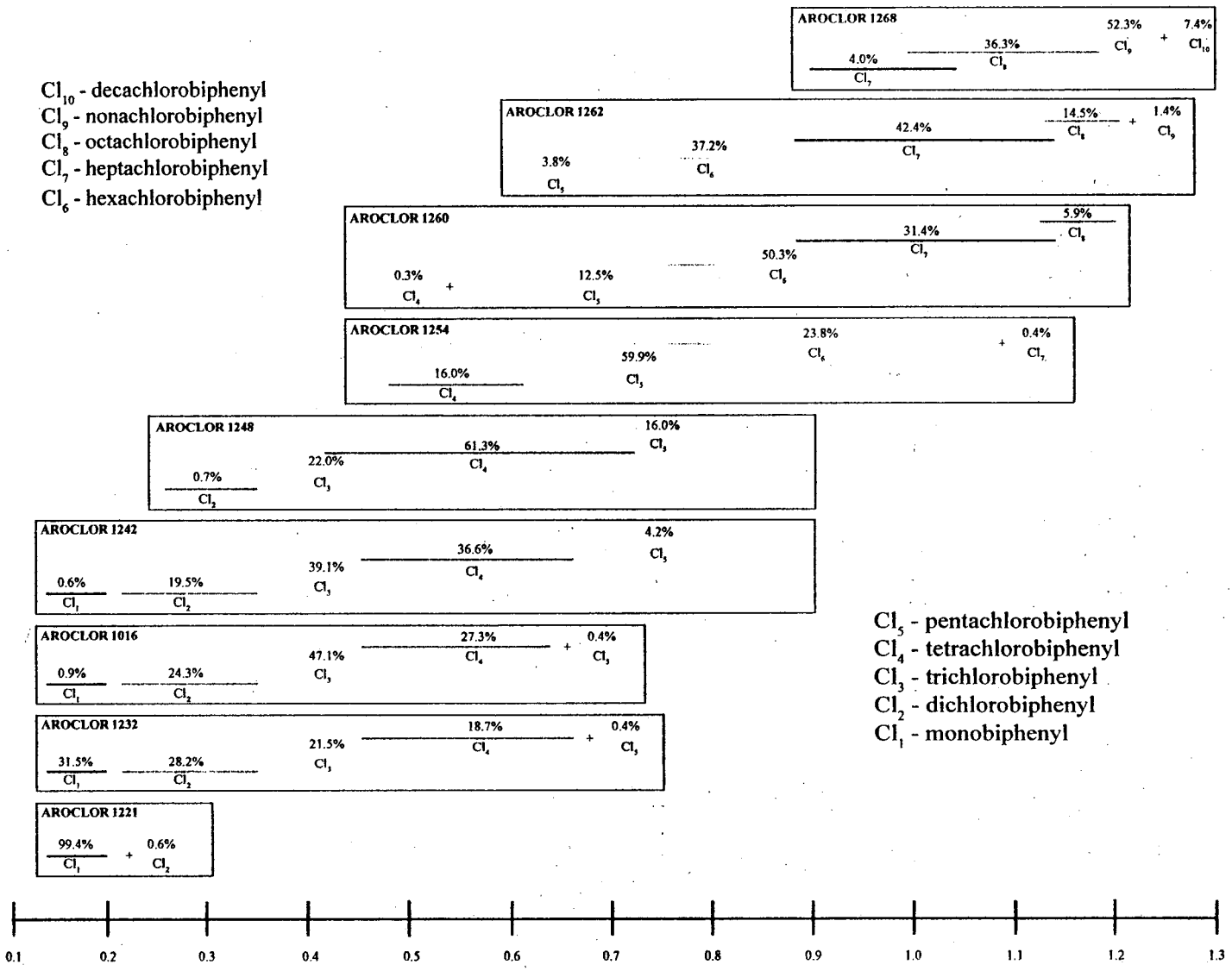

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Table 1. Composition of PCBs by Homolog[1]

Homolog	Molecular Formula	Molecular Weight	Chlorination (%)	Number of Congeners
Biphenyl	$C_{12}H_{10}$	154.1	0	1
Monochlorobiphenyl	$C_{12}H_9Cl$	188.0	19	3
Dichlorobiphenyl	$C_{12}H_8Cl_2$	222.0	32	12
Trichlorobiphenyl	$C_{12}H_7Cl_3$	256.0	41	24
Tetrachlorobiphenyl	$C_{12}H_6Cl_4$	289.9	49	42
Pentachlorobiphenyl	$C_{12}H_5Cl_5$	323.9	54	46
Hexachlorobiphenyl	$C_{12}H_4Cl_6$	357.8	59	42
Heptachlorobiphenyl	$C_{12}H_3Cl_7$	391.8	63	24
Octachlorobiphenyl	$C_{12}H_2Cl_8$	425.8	66	12
Nonachlorobiphenyl	$C_{12}HCl_9$	459.7	69	3
Decachlorobiphenyl	$C_{12}Cl_{10}$	493.7	71	1

(1) Analytical Chemistry of PCBs, Second Edition, Mitchell D. Erikson, 1997

Table 2. WHO Congeners

Formula Name	IUPAC
3,3',4,4'-Tetrachlorobiphenyl	BZ 77
3,4,4',5-Tetrachlorobiphenyl	BZ 81
2,3,3',4,4'-Pentachlorobiphenyl	BZ 105
2,3,4,4',5-Pentachlorobiphenyl	BZ 114
2,3',4,4',5-Pentachlorobiphenyl	BZ 118
2,3',4,4',5-Pentachlorobiphenyl	BZ 123
3,3', 4,4',5-Pentachlorobiphenyl	BZ 126
2,3,3',4,4',5-Hexachlorobiphenyl	BZ 156
2,3,3',4,4',5-Hexachlorobiphenyl	BZ 157
2,3',4,4',5,5'-Hexachlorobiphenyl	BZ 167
3,3',4,4',5,5'-Hexachlorobiphenyl	BZ 169
2,2',3,3',4,4',5-Heptachlorobiphenyl	BZ 170
2,2',3,4,4',5,5'-Heptachlorobiphenyl	BZ 180
2,3,3',4,4',5,5'-Heptachlorobiphenyl	BZ 189

The term co-planar refers to congeners with no or limited substitution of chlorine in the 2,2' or 6,6' positions (figure 1). In theory, with no chlorine in the 2,2' position, the two biphenyl rings can rotate to common plane confirmations. This molecule can potentially mimic the effect of dioxin in a biological system because the biphenyl rings are in the same steric position as dioxin. The PCB homolog classification reflects the number of chlorine atoms that are bonded to a biphenyl molecule (figure 1). All tri-chlor substituted congeners are refered to as the trichlorobiphenyl homologs. Table 1 summarizes all possible congeners and the percent chlorination for PCBs by homolog grouping. Figure 2 shows the relationship between the degree of chlorination and specific aroclors. The aroclors are presented as distributions by relative retention time when analyzed by gas chromatography (GC). The weight percent distribution of the homologs is also presented.

In reviewing figure 2, aroclor 1260 (60% by weight of chlorine) has 31.4% of its total chlorine content in the heptachlorobiphenyl homolog group and 50.3% in the hexchlorobiphenyl homolog group. This aroclor is dominated by higher-molecular-weight homologs and void of the lower molecular weight homologs.

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EPA Method 680 provides a valuable tool for total PCB quantitation for difficult matrices and weathered PCBs because mass spectrometry (MS) can filter potential interferences that can mask the PCB peaks. Additionally, target congeners can be identified and quantified in the same analytical run as the homolog analysis. High-resolution gas chromatography (GC) is coupled with low-resolution mass spectrometry (MS) to perform the analysis. As the degree of chlorination increases, the molecular weight of the congener increases. The GC column disperses the congeners over the GC run as a function of the molecular weight distribution of the congeners (figure 2). Increased molecular size results in longer GC retention times. The mass spectrometer is used to detect congeners according to their homolog groups.

Utilizing low-resolution mass spectrometry negates the potential lack of identification of PCB aroclors that could occur when using methods such as EPA 8082 (GC/ECD). In complex matrices or in weathered PCB samples, where a specific aroclor cannot be determined, the mass spectrometer provides enhanced identification. Operating the mass spectrometer in the selected ion-monitoring mode (SIM) averts additional sample matrix interferences. Also, GC/MS can provide specific identification of congeners that may have a greater health risk such as those in Table 2.

Woods Hole Group has used EPA Method 680 to evaluate PCB homologs in water, soil, sediment and biota. The limits of quantitation for "Total PCB"-based or homolog - based risk models is on the order of 1 to 10 ng/L for water and 1 to 10 ug/Kg for solid matrices. The enhanced specificity of the molecular fingerprint provided by the mass spectrometer offers an additional comfort level for non-routine site investigations.

For more information, please contact our General Manager, Nicholas P. Corso, our Laboratory Director, Peter J. Kane, or one of our project managers.

About Woods Hole Group

Woods Hole Group Environmental Laboratories, with 25 highly qualified staff, provides risk-based, specialty, and compliance-based analytical services for our clients.

Our specialty analysis capabilities, which include congener PCB, alkylated PAH, and tissue residue analyses, provide the low detection limits needed for risk-based studies. We also have the staff and facility (Class 100 room) to perform difficult trace metal analyses in seawater and tissues.

We feature EPA SW-846 organic and trace metal analyses and other EPA wet chemistry capabilities (e.g. TOC, TPH, nutrients, cyanide) required for compliance studies.

The Woods Hole Group is committed to generating technically and legally defensible data in accordance with our comprehensive Quality Assurance/Quality Control (QA/QC) Program. We maintain several state laboratory certifications, U.S. Army Corps of Engineers certification, and regularly participate in intercalibration and performance evaluation programs.

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